UNDERGROUND
ENGINEERING &
ENVIRONMENTAL
SOLUTIONS

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September 14, 2001
File No. 27960-001

Mr. Brian Mossman
Boeing Realty Corporation
3855 Lakewood Blvd.
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Long Beach, CA 90846

Subject: **Extended Soil Vapor Extraction Pilot Test Workplan**
Former Building 2
Boeing Realty Corporation
Former C-6 Facility
Los Angeles, California

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This Extended Soil Vapor Extraction (SVE) Pilot Test Workplan has been prepared to address soils impacted with volatile organic compounds (VOCs) in localized areas of Parcel C, at the former Boeing C-6 Facility (subject property), in Los Angeles, California. The design of the vapor extraction pilot test in the former Building 2 area follows the same design as contained in the Extended SVE Pilot Test WorkPlan for the Buildings 1 and 36 Area, approved by the California Regional Water Quality Control on June 7, 2001.

The purpose of the extended pilot test is to collect VOC mass removal and vacuum/flow influence area data to evaluate the need for full-scale implementation. A secondary benefit of the extended pilot test will be overall VOC mass reduction in the soil source area. The extended pilot test will focus on unsaturated soils at depths greater than approximately 10 feet below ground surface (bgs) beneath the former Building 2 area at the subject site. Subsurface soils in this area contain chlorinated solvents, primarily trichloroethene (TCE), with maximum concentrations up to 340,000 micrograms per kilogram (µg/kg).

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20 September 2001
C6-BRC-T-01-020

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
Los Angeles Region
320 W. 4th Street, Suite 200
Los Angeles, CA 90013

BOEING

Attention: John Geroch

Subject: **EXTENDED SOIL VAPOR EXTRACTION PILOT TEST WORKPLAN FOR BOEING REALTY CORPORATION, FORMER C-6 FACILITY, 19503 SOUTH NORMANDIE AVENUE, LOS ANGELES, CA**

Dear Mr. Geroch:

Please find enclosed for your review, a copy of the subject document prepared by Haley & Aldrich, Inc. for Boeing Realty Corporation.

If you have any questions concerning this document, please contact the undersigned at 562-593-8623.

Sincerely,

Stephanie Sibbett
Boeing Realty Corporation

Cc: Mario Stavale, Boeing Realty Corporation

enclosure

1.0 BACKGROUND

1.1 SITE LOCATION AND DESCRIPTION

The subject property comprises approximately 170 acres at 19503 South Normandie Avenue in Los Angeles, California (Figure 1). The property is bordered on the north by West 190th Street; on the east by railroad tracks and South Normandie Avenue; on the south by Montrose Chemical Company and residential properties; and on the west by Western Avenue, Capitol Metals, and International Light Metals (ILM).

Between 1952 and 1992, the Douglas Aircraft Company (DAC) used the facility to manufacture aircraft and aircraft components. DAC used the facility for storage and warehousing until 1996.

Aboveground and underground structures have been removed from the site. The site is currently being graded for redevelopment, which is scheduled to begin in the first half of 2002.

1.2 HYDROGEOLOGY/GEOLOGY

The hydrogeologic units relevant to this scope of work are comprised of Holocene and Pleistocene-age alluvium deposits. The upper portions of the site/area geology are composed of the Bellflower Aquiclude (ground surface to approximately 140 feet bgs) consisting of clays and silts, and flood plain deposits composed of silt and sand grading into thinner beds with minor amounts of clay. The upper 30 to 35 feet of the vadose zone is finer grained than the lower 25 to 30 feet. The Gage Aquifer (approximately 150 to 180 feet bgs) underlies the Bellflower Aquiclude (Montgomery Watson, 1994).

At the site groundwater occurs at approximately 60 to 70 feet bgs in a semi-perched aquifer flowing south-southeast at an approximate hydraulic gradient of 0.0007 feet per foot (ft/ft) to 0.0027 ft/ft (Kennedy/Jenks 2000b).

2.0 INVESTIGATION RESULTS - SUBJECT AREA

The site has undergone numerous phases of site characterization to define the vertical and lateral extent of VOCs in the soil and groundwater in the vicinity of former Building 2. The area targeted for this extended SVE pilot test includes VOC-impacted soils from

approximately 12 to 65 feet bgs. These soils contain TCE concentrations of up to 340,000 micrograms per kilogram (µg/kg) in the western portion of Building 2.

2.1 INITIAL PILOT TEST

In August 1993, Montgomery Watson performed an initial 48-hour SVE pilot test between Buildings 1 and 36 to estimate the vacuum radius of influence (ROI) and mass removal rates. The test used Well RW-1 as the extraction well and temporary nested probe locations P-1 and P-2 as the observation points. Wells P-1 and P-2 were constructed with discrete soil probes set at approximately 20 feet, 40 feet, and 60 feet bgs.

The limitations of the previous testing performed by Montgomery Watson include:

- The SVE pilot test was conducted in a different area of the site that contains a different combination of VOCs.
- Only two data values under non-constant conditions were used for the ROI calculations.
- Only 11 data points (vacuum and flow data) were collected over the 2-day period. Additional data points are necessary for full-scale system evaluation.
- Vacuum data showed decreasing trends throughout testing; therefore, steady-state testing conditions were not achieved.
- Mass removal rate was approximately 1.5 pounds of VOCs per hour at a flowrate of approximately 20 to 33 standard cubic feet per minute (scfm).

2.2 BUILDINGS 1 AND 36 AREA EXTENDED PILOT TEST

In July, 2001, Haley & Aldrich installed 6 multi-depth SVE wells and initiated an extended pilot test in the Buildings 1 and 36 area. The pilot test equipment included a 250-scfm capacity blower, liquid knockout, two 8,000-lb capacity granular activated carbon (GAC) vessels, and interconnecting piping. The SVE system was permitted for operation under a South Coast Air Quality Management District (SCAQMD) multiple locations permit.

A series of step tests and constant rate tests were conducted to measure the vacuum propagation under different applied vacuums. Step tests included high-density data collection during the first minutes of each test to capture the transient conditions of the porous matrix under vacuum stresses. These data were then used to develop the treatment area gradients and flow rates through curve fitting. The SVE extended pilot test in this area is still in progress.

During the period of July 2 through August 17, 2001, the Buildings 1 and 36 pilot test data indicate:

- The inlet vacuum ranged from 20 to 100 inches of water column.
- Flow rates ranged from 11.0 to 186.2 scfm.
- Inlet VOC concentrations ranged from 135 to 10,763 ppmV.
- Approximately 1,150 lbs of total VOCs were recovered from wells VEW-1A and VEW-1B during the operational period, based on laboratory data.
- Calculated VOC mass removal rates ranged from approximately 1.6 to 200 lbs per day, depending on flow rates and inlet concentrations.
- Transient vacuum propagation curve fitting of data from the shallow wells (8-30 feet bgs) and deep wells (40-65 feet bgs) yielded a dramatic drop in gradient and flow beyond 30 feet from the extraction wells, suggesting an effective treatment radius of approximately 30 feet from each well.
- Pilot test data at 32 scfm was used to model the sensitivity of the treatment area to air flow distribution around an extraction well. Modeling results indicate that the air flow distribution was roughly equivalent up to 100 scfm. This suggests that vacuum gradient is not sensitive to flow rate and a unit flowrate of approximately 1.5 scfm per foot of well screen is adequate.
- The calculated transmissivity in the shallow vadose zone is approximately one order of magnitude higher than the deep zone. This is likely due to vertical air leakage from the surface since the area is unpaved and recently re-graded.

- GAC adequately treats the waste stream and SCAQMD requirements.

These data and preliminary calculations were used as design criteria for the Building 2 extended SVE pilot test.

3.0 EXTENDED SVE PILOT TEST PURPOSE, SCOPE, AND DESIGN BASIS

3.1 PURPOSE

The purpose of the extended SVE pilot test is to obtain design parameters for evaluation of a final SVE soil remedy in Building 2.

3.2 SCOPE

It is anticipated that the Building 2 extended SVE pilot test will operate for approximately 6 months during on-site construction and grading activities. During this time, SVE operational parameters will be collected and evaluated. These will include soil vapor concentrations, mass removal rates, flow and vacuum ROI, and treatment system efficiency. During extended pilot test operation, the data will be reviewed to evaluate if continued SVE operation is advantageous to the site.

3.3 DESIGN BASIS

Selection of the extended pilot test methodology was based on the initial SVE pilot test (Montgomery Watson 1994), the Buildings 1 and 36 extended SVE pilot test by Haley & Aldrich, and regulatory requirements as summarized below:

- SVE well spacing will be based on an approximate 30-foot ROI. Closer spacing will be used for areas where shorter cleanup time frames are desired or remediation in the shallow zone is preferred and vertical air leakage reduces the effective ROI.

- Design the extraction and treatment system to operate wells at an optimum of 1.5 scfm per foot of well screen.

- During start-up, collect vapor concentration data to evaluate initial VOC concentrations. Compare calculated mass removal values to estimated mass using soil concentration data to evaluate the degree of VOC reduction that will be feasible in a 6-month operational time frame.

- Evaluate mass of VOCs present and estimate duration of SVE treatment using modeling. Perform sensitivity analysis on cleanup time using various flow rate and well spacing scenarios.

- Collect long-term pilot test operational data (VOC concentration and mass flux data) to evaluate performance-based limitations of SVE treatment for incorporation into the final site soil remedial action plan.

- Use a trailer-mounted SVE blower package with a South Coast Air Quality Management District (SCAQMD) various locations permit.

- The pre-permitted SVE system will require an air flowrate capacity of up to approximately 800 cubic feet per minute (cfm) at 136 inches of water column (in. H_2O).

- Use GAC for vapor emission control during the pilot test.

- The upper 30 to 35 feet of the vadose zone consists of finer grained silts and the lower 30 feet consists of sandy silts. To treat these two zones, fifteen SVE wells are proposed; nine multi-screened interval wells and six single-screened interval wells (see Figure 2).

- The SVE wellhead connection to the vapor recovery piping can be made at-grade. Similarly, piping runs will be installed aboveground.

4.0 BUILDING 2 EXTENDED SVE PILOT TEST IMPLEMENTATION

4.1 PILOT TEST WELL INSTALLATION

The fifteen proposed SVE pilot test wells will have dual- and single-screened intervals to accommodate the flow and vacuum conditions that may be present in the two primary

geologic horizons of the vadose zone. Six wells will be single-completion wells; nine will be dual-completion.

Vapor extraction wells will be installed in hollow-stem auger borings. For the dual-completion wells, the upper well sections will consist of 2-inch inner diameter (ID) polyvinyl chloride (PVC) well casing and screen with a 0.020-inch slot, screened from approximately 15 to 35 feet bgs. The lower well completions will consist of 2-inch ID PVC casing and screen with a 0.020-inch slot, screened from approximately 45 to 65 feet bgs. The single-completion wells will be 2-inch ID PVC casing and screen with a 0.020-inch slot, screened from approximately 15 or 30 feet to 65 feet bgs. The screened intervals vary based on location and may be adjusted in the field based on local lithology and field screening for VOCs with the screens being placed to intersect the most highly VOC-impacted zones. The screened intervals will be packed with #3 sand, bentonite seals will be placed between the well casings, and bentonite grout will be placed from approximately 6 inches above the top screens to 2 feet bgs. The wells will be finished at the surface with a 6-inch diameter PVC protective sleeve and outer concrete skirt raised above the surrounding grade. Well casing risers will be connected to the SVE system with wellhead piping and valves. The location of the proposed wells are shown on Figure 2. A dual-completion well detail is included on Figure 3.

4.2 Pilot Test System Design and Construction

The temporary SVE pilot test equipment will consist of a fenced treatment compound, aboveground piping, two 3,000-lb GAC canisters for off-gas treatment, a water knockout, and a vacuum blower rated at 800 scfm at 136 inches of water column. A schematic of the VES unit and activated carbon treatment vessels is shown on Figure 4.

4.2.1 Piping

The piping will consist of 6-, 4-, and 3-inch diameter, schedule 40 PVC. Piping from the treatment wells will be routed to a PVC header pipe located in the treatment compound (Figure 2). Wells will be equipped with ball valves to regulate flow, a labcock sample valve (which can be removed to insert a flow measurement device), and a vacuum gauge. The main header pipe leading to the vapor extraction equipment will be equipped with a labcock sample valve and flow-sensing device for SCAQMD permit compliance monitoring.

4.2.2 Pilot Test Equipment Compound

To accommodate the trailer-mounted VES unit, a 6-inch thick course of aggregate will be placed in an approximately 30 by 30-foot area in the western portion of the site near the former Building 19. (Figure 2). The aggregate will be compacted to provide a stable, level surface. The VES equipment will be enclosed by an 8-foot-high chain-link fence with 3-strand barbed wire. The fence will have a swing gate for access.

4.2.3 Electrical Service

Electrical service (a temporary construction power pole) will be installed near the treatment compound. Electrical power connection will be made to the treatment equipment in accordance with local building codes pertaining to construction jobsite service and manufacturer specifications.

4.2.4 Equipment Startup and Operation and Maintenance

For the duration of the pilot test, weekly operation and maintenance of the equipment will be performed to ensure that SCAQMD permit compliance is met, operation parameters are recorded and optimized, and maximum mass removal is maintained.

Data collected during system operation will include power readings, influent vapor flowrate, vacuum, temperature, and inlet/midpoint/outlet VOC concentrations. VOC concentrations will be measured using an FID or PID. These measurements will be supplemented with permit-stipulated Tedlar bag or Summa canister influent and effluent samples to verify field measurements and calculate mass removal rates. Vapor samples will be analyzed for VOCs by EPA Method TO14.

4.3 PERMITTING

A SCAQMD-pre-permitted, trailer-mounted SVE unit will be operated under an extended pilot test basis. Because the proposed system is within a construction site on a temporary basis, it is anticipated that no building or electrical permits will be required.

The proposed vapor extraction well is within the vadose zone; therefore, permits from the Los Angeles County Department of Health for installation are not required.

5.0 HEALTH AND SAFETY

The site-specific Health and Safety Plan (HASP) prepared by Haley & Aldrich for worker safety will be amended prior to system installation and operation to include construction oversight, and operation and maintenance of the treatment system.

6.0 UNDERGROUND UTILITIES

Underground utilities within Parcel C have reportedly been removed as part of site demolition. Installation of new utilities within the pilot test area will be identified and coordinated with the site developer, if necessary.

7.0 PERSONAL PROTECTIVE EQUIPMENT (PPE)

All site personnel will be equipped, at a minimum, with Level D safety gear (e.g. hard hat, steel-toed boots, and traffic vest). Because dust may be a problem and chlorinated hydrocarbons and moderate concentrations of metals are known to exist in site soils, workers should monitor ambient dust levels using Occupational Safety and Health Administration (OSHA)-approved dust monitoring equipment. If dust levels exceed HASP requirements, dust control and/or proper PPE such as respirators should be used. HASP requirements will be implemented during system operation.

8.0 REPORTING

Upon completion of the extended pilot test, a report will be prepared describing system operation, monitoring activities, and system performance. A well construction log and a discussion of system construction specifics will be included with the report. VOC monitoring data will be included in tables, figures, and graphs to illustrate influent concentrations, destruction efficiency and the volume of VOCs removed to date. Other measurements taken in the field will also be presented in tabular format. The final report on the Building 2 extended SVE pilot test will be submitted to the LARWQCB by August 30, 2002.

This opportunity to be of service is appreciated. If you have any questions, please do not hesitate to contact the undersigned.

Sincerely yours,
HALEY & ALDRICH, INC.

Richard M. Farson, P.E.
Senior Engineer

REGISTERED PROFESSIONAL ENGINEER
RICHARD M. FARSON
47269
EXPIRES 12/31/03
CIVIL
STATE OF CALIFORNIA

Scott P. Zachary
Vice President

Figures 1 through 4

References:

Kennedy/Jenks. 1996. Phase I Environmental Assessment, Douglas Aircraft C-6 Facility, Parcel C. May.

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Kennedy/Jenks. 2000b. Groundwater Monitoring Report, 2nd Quarter 2000, Boeing Realty Corporation's C-6 Facility, Los Angeles, CA. July.

Montgomery Watson. 1994. Conceptual Design of Final Soil and Groundwater Remediation System at the Douglas Aircraft Company. March.

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Figures

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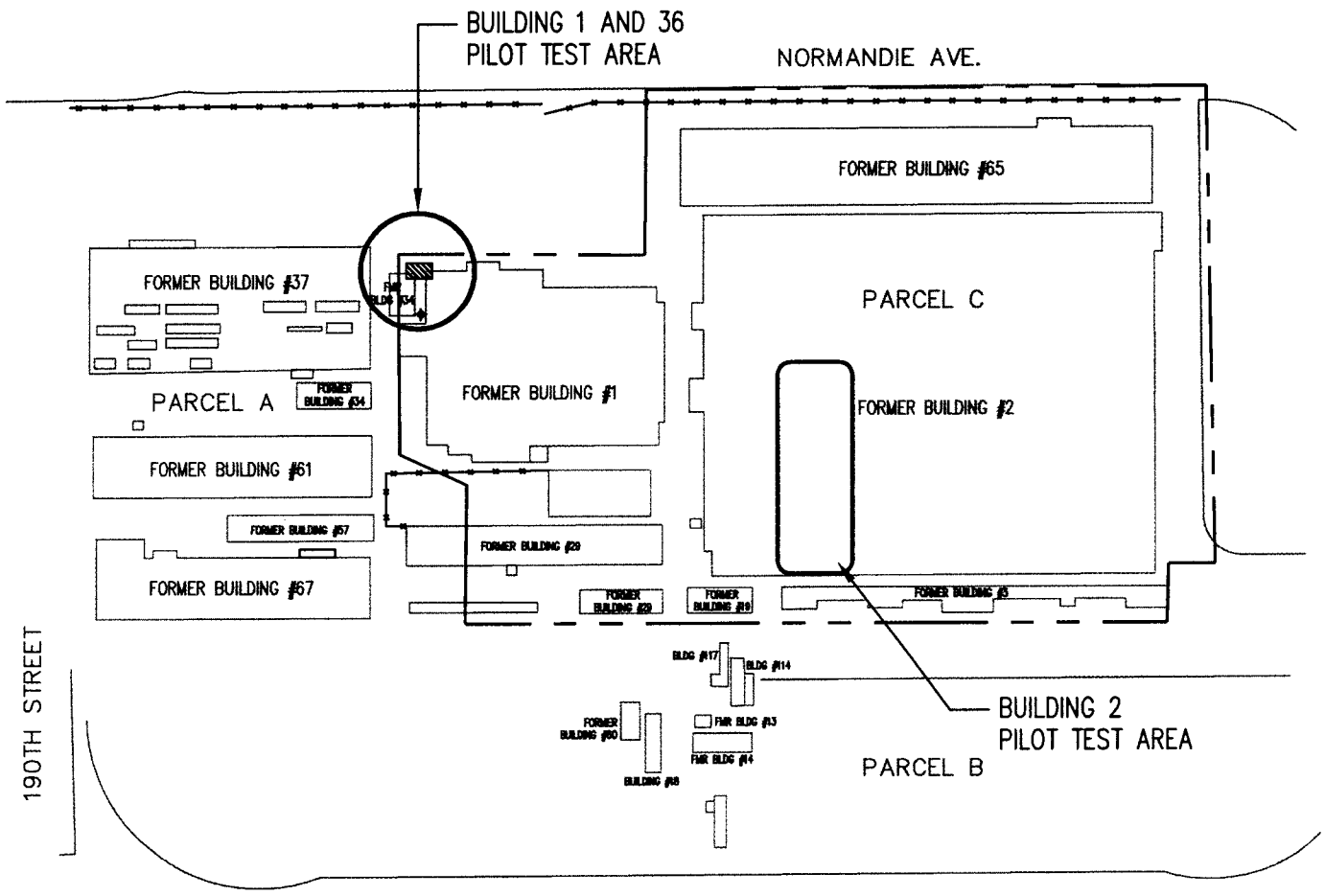

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FIGURE: 1

BUILDING 2 AREA EXTENDED VES PILOT TEST SITE PLAN

SCALE: AS SHOWN | PROJECT: 27960-001
DRAWN: SAL | REVIEWED: RMF | DATE: 5 SEPT., 2001

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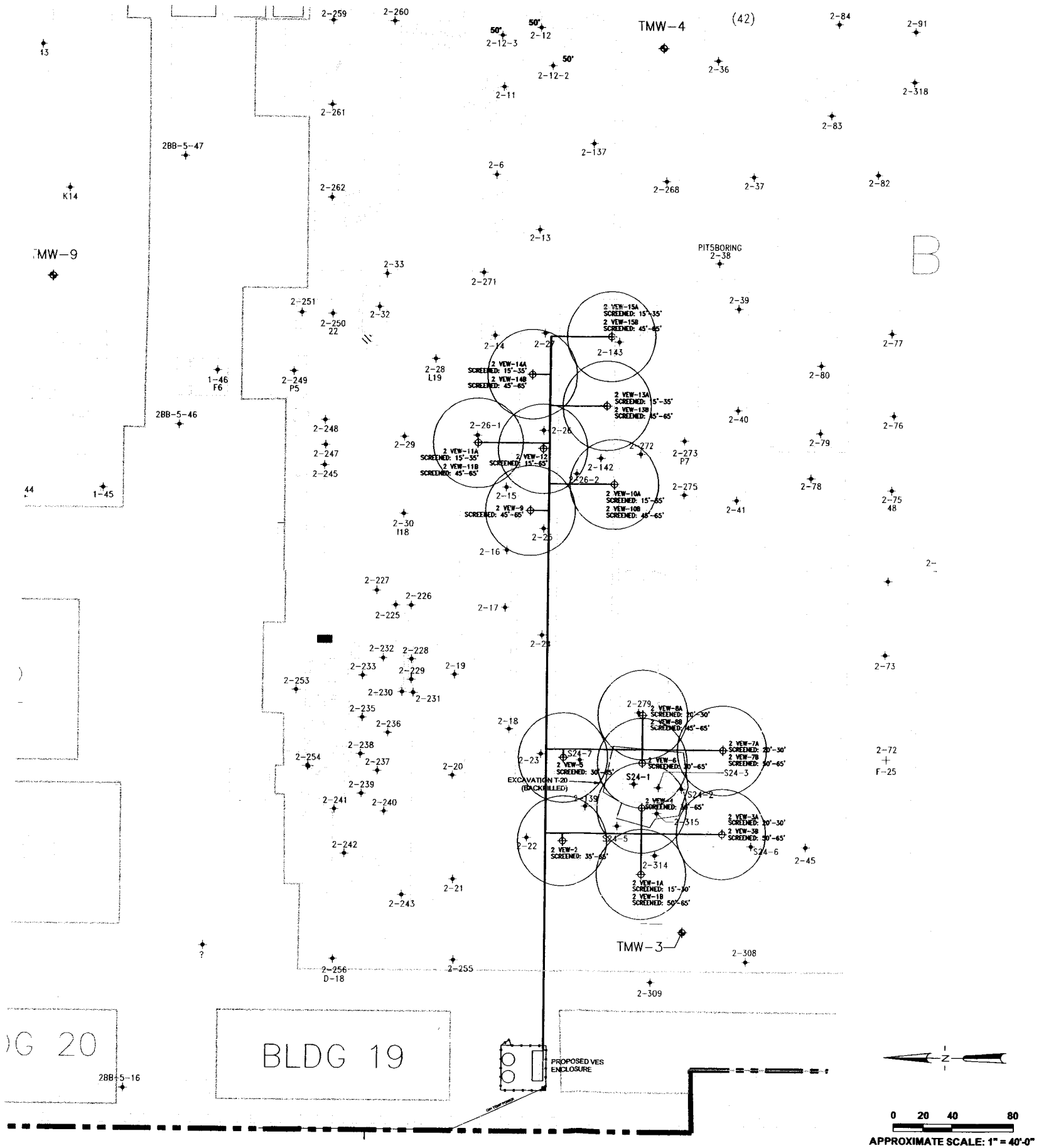

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FIGURE: 2

BUILDING 2 AREA PROPOSED EXTENDED VES PILOT TEST LAYOUT

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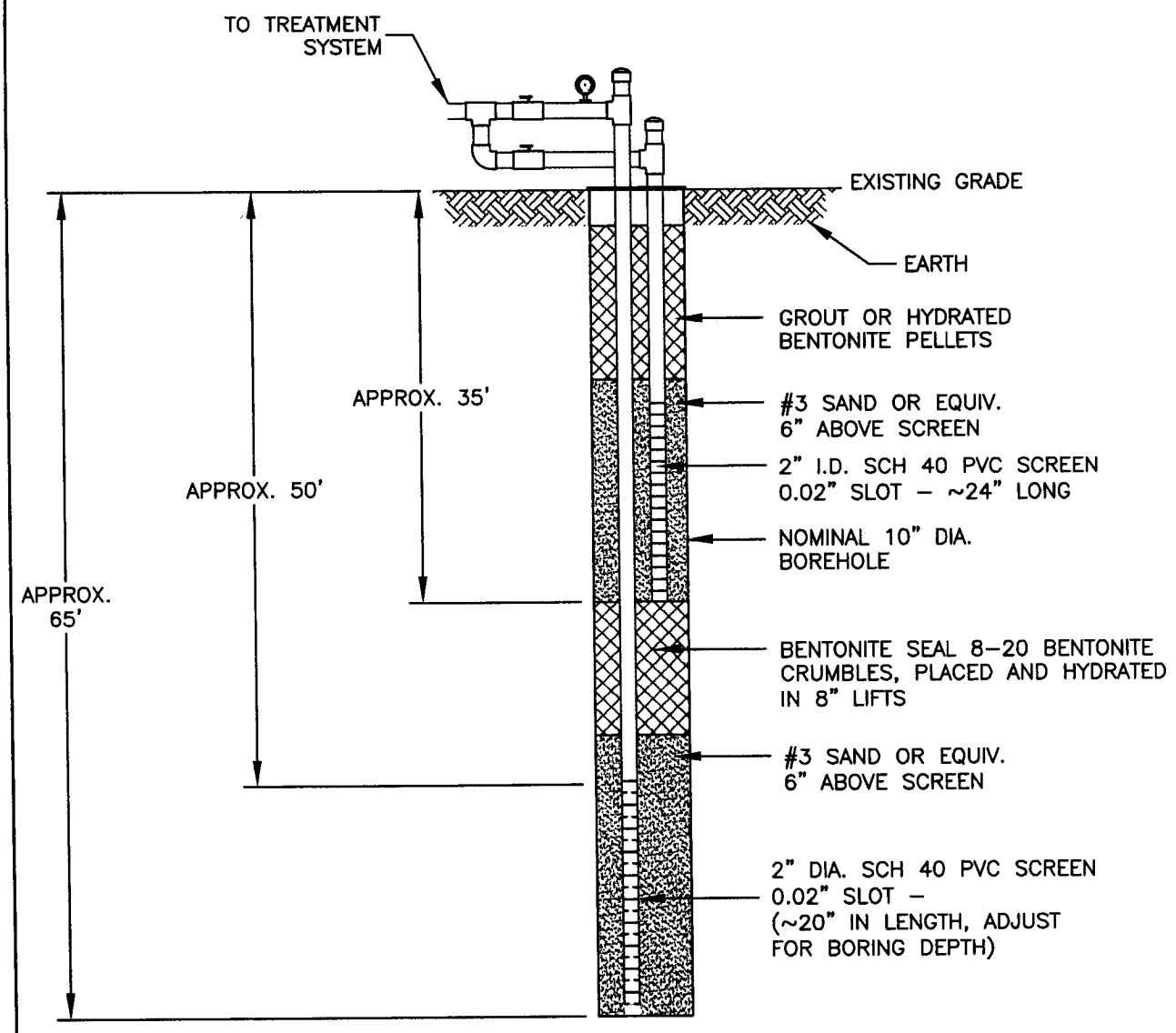

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FIGURE: 3

BUILDING 2 AREA
EXTENDED VES PILOT TEST
SOIL VAPOR EXTRACTION WELL DETAIL

SCALE: NTS		PROJECT: 27960-001
DRAWN: SAL	REVIEWED: RMF	DATE: 5 SEPT., 2001

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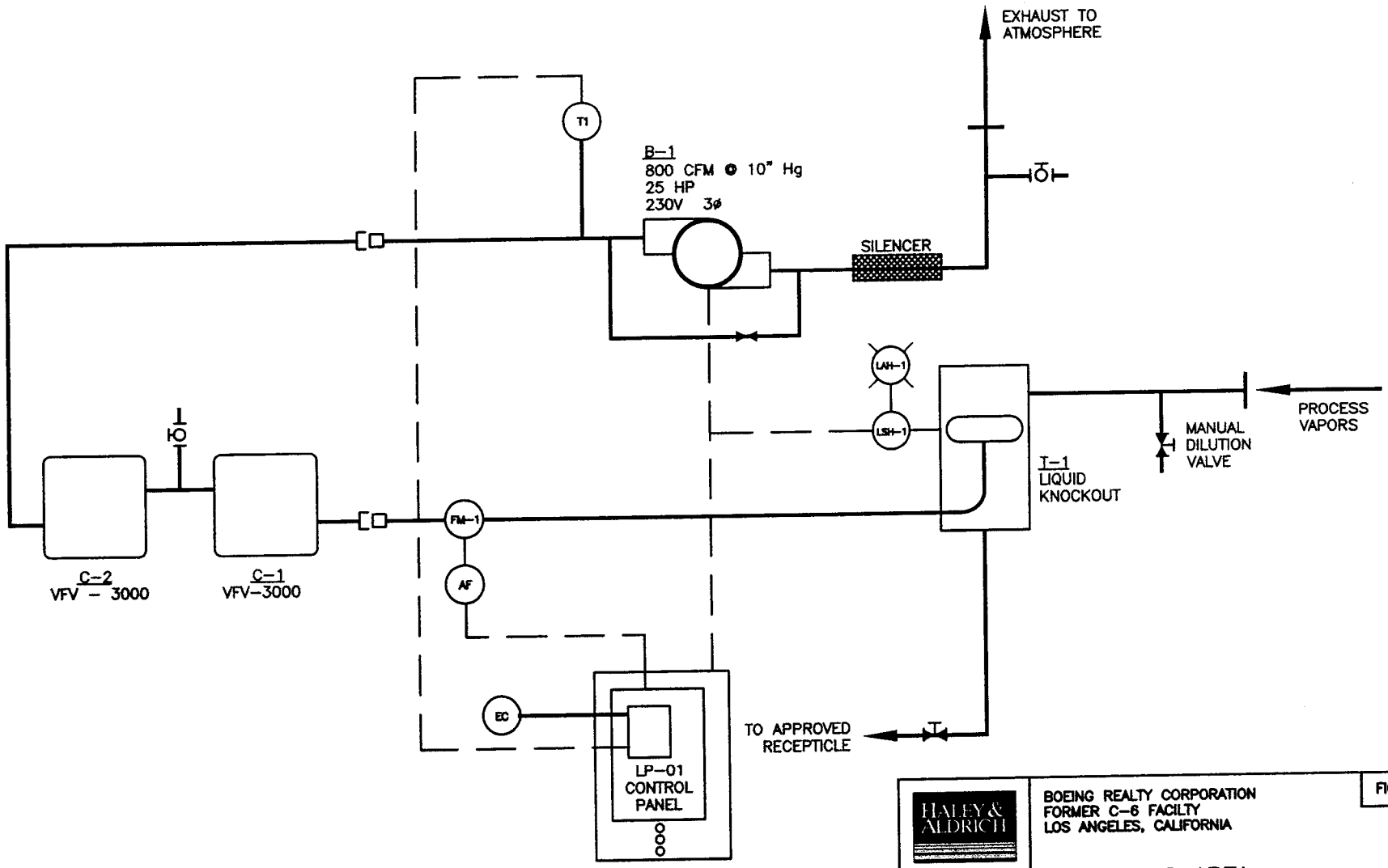

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FIGURE: 4

BUILDING 2 AREA EXTENDED VES PILOT TEST EQUIPMENT SCHEMATIC

SCALE: AS SHOWN | PROJECT:

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